

REMARKS

Claims 1-5, and 7-18 are pending herein.

1. Claims 1-5, 8-13, and 15-18 were rejected under 35 U.S.C. 103(a) as being unpatentable over Weismann et al. (6,794,339) in combination with either deBarbadillo, II et al. (4,962,085) or Yoshida (5,206,216) further in combination with Lee et al. (2004/0163597) further in combination with Reeves et al. (2005/0014653). This rejection is respectfully traversed for the following reasons.

The claimed invention is drawn to a process for producing long lengths of layered superconductor. The claimed invention particularly calls for coating a buffered metal substrate tape with precursors by metalorganic deposition (MOD) to form a coated tape, and translating the coated tape through a precursor conversion zone at a rate of at least about 10 meters per hour. Further, the process call for introducing oxygen and water vapor through a showerhead into the conversion zone while translating the tape.

Conversion or completion of MOD films is an *ex situ* process, i.e. the conversion occurs after coating the tape with precursors. In contrast, CVD is an *in situ* process in which the superconductor is formed simultaneous with deposition of precursors. CVD does not require an additional step to convert the precursors to a superconductor film. Similarly, PVD, such as laser deposition carried out by ablating a preformed superconductor to form a film, does not require conversion. Consequently, neither CVD nor PVD such as laser ablation is concerned with distribution of conversion gases.

During the MOD conversion process, conversion of deposited precursor occurs very slowly, with film conversion on the order of one Å per second. This is of particular importance in a dynamic process wherein the substrate is translated through the conversion zone. Here, the throughput of the process is a function of the conversion rate and the size of the conversion zone. State of the art dynamic MOD processes are limited to a throughput of about 1 meter per hour or less. That is, increasing the throughput requires increasing either the size of the conversion zone, the conversion rate, or both. However, Applicant has discovered that in the context of a dynamic process in which a tape is translated through a conversion zone, it is quite difficult to maintain

uniform distribution of water vapor over a large conversion zone. Accordingly, Applicant has discovered that incorporating a showerhead into the claimed process flow for distribution of oxygen and water vapor not only improves throughput a full order of magnitude, but also improves the crystallographic texture of the converted superconducting coating, thereby providing improved superconducting properties of the coating.

Turning to the cited prior art, Weismann discloses a static MOD process flow. That is, the substrate is placed in a furnace for conversion, rather than translated through a conversion zone. Further, Weismann teaches flowing the conversion gasses (oxygen and water vapor) from an inlet in the furnace to an outlet on the opposite end of the furnace. See FIG. 2 and col. 7 line 63 through col. 8, line 11 of Weismann. Weismann also teaches a multistep approach, in which the precursor is first converted at a temperature above 500°C in the presence of oxygen and water vapor, and then the resulting superconductor is further oxidized below 500°C in pure oxygen. See col. 7 lines 20-32 of Weismann. Weismann does not recognize the particular challenges for a dynamic conversion process, and further, does not teach or remotely suggest translating the tape through a conversion zone at a rate of at least about 10 meters per hour or introducing oxygen and water vapor through a showerhead.

DeBarbadillo teaches a method for oxygenation of a superconducting tape. Particularly, the oxygenation step is carried out at about 400°C, corresponds to the below 500°C oxygenation step of Weismann. DeBarbadillo discloses a method of supplying pure oxygen to an oxidation zone. Yoshida teaches a laser deposition method to deposit a preformed bulk superconductor as a film on a substrate tape. As previously discussed, laser deposition is a significantly different process than the claimed MOD conversion process. The PTO acknowledges the combination of Weismann and DeBarbadillo or Yoshida fail to teach the use of a showerhead to supply oxygen and water vapor to the conversion zone. Additionally, Weismann and DeBarbadillo or Yoshida provide no recognition of the problem regarding even distribution of water vapor throughout the conversion zone during a dynamic conversion process.

The PTO turns to Lee and Reeves to allegedly overcome the deficiencies of Weismann and DeBarbadillo or Yoshia. Lee teaches a MOCVD method for depositing a film to a wafer. As previously discussed, MOCVD is an *in situ* process where precursors are converted to a

superconductor film as they are applied to the substrate. Additionally, Lee teaches a static method of applying a film to a substrate, rather than a translating tape. As such, Lee does not contribute to the understanding of the importance of evenly distributing water vapor throughout a conversion zone during a dynamic process in which the substrate tape is being translated.

Reeves teaches a method of analyzing a superconductor tape by x-ray diffraction. While Reeves teaches the analysis can occur while the tape is translating at a rate of between 0.3 meters/hr and 10 meters/hr, there is no disclosure of how an MOD conversion process would occur at a translation rate of 10 meters/hr. In fact, Reeves recognizes that various techniques for forming a superconductor film have different requirements. Specifically, in par. [0037], Reeves teaches that laser deposition has a high deposition rate and CVD techniques can be used for large area treatment. Certainly, a PLD process with a high deposition rate can be translated at a high translation rate, but nowhere does Reeve teach or suggest a process by which MOD conversion can occur at a translation rate of 10 meters/hr.

Further, Applicant respectfully submits that absent Applicant's own disclosure, that one of ordinary skill in the art would not have combined the static *ex situ* MOD process of Wiesmann with the dynamic deposition process of Yoshida or the dynamic oxidation process taught by deBarbadillo, II et al. and incorporated the showerhead of Lee et al., let alone the translation rate of Reeves, therein. The cited prior art fails to recognize the particular need for uniform distribution of O₂ and water vapor throughout such a conversion zone in the dynamic MOD conversion process of the claimed invention.

Additionally, as stated above, Applicant has discovered that utilization of a showerhead in the context of the claimed dynamic conversion process addresses notable challenges in the context of a dynamic, continuously translating tape in MOD. Particularly, incorporation of a showerhead for flow of conversion gases in the claimed dynamic process significantly improves the throughput of the process. The art of record nowhere discloses or even remotely suggests such advantages, and such advantages are indicative of the non-obviousness of the claimed invention. It is also emphasized that it was Applicant's discovery, not that of the prior art, of degradation and superconducting properties when converting from a static conversion process to a dynamic conversion process, which lead to development of the claimed invention.

For at least the foregoing reasons, Applicant respectfully submits that the presently claimed invention would not have been obvious over the cited prior art. Accordingly, reconsideration and withdrawal of the 103 rejection is respectfully requested.

2. Claim 7 was rejected under 35 USC 103(a) as being unpatentable over Weismann et al. in combination with either deBarbadillo, II et al. or Yoshida further in combination with Lee et al. further in combination with Reeves et al. further in combination with Manabe et al. or Weinstein. Claim 14 was rejected under 35 USC 103(a) as being unpatentable over Weismann et al. in combination with either deBarbadillo, II et al. or Yoshida further in combination with Lee et al. further in combination with Reeves et al. further in combination with Ott et al. Applicant respectfully submits that Manabe et al., Weinstein, and Ott et al. fail to address the deficiencies of Weismann et al., deBarbadillo, II et al., Yoshida, Lee et al. and Reeves et al. as discussed above. Accordingly, withdrawal of these rejections is respectfully requested as well.

Applicant respectfully submits that the present application is now in condition for allowance. Accordingly, the Examiner is requested to issue a Notice of Allowance for all pending claims.

Should the Examiner deem that any further action by the Applicant would be desirable for placing this application in even better condition for issue, the Examiner is requested to contact Applicant's undersigned attorney at the number listed below.

The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-3797.

Respectfully submitted,

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Date

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